(12) UK Patent Application (19) GB (11) 2 308 692 (13) A

(43) Date of A Publication 02.07.1997

(21) Application No 9626730.7

(22) Date of Filing 23.12.1996

(30) Priority Data
(31) 9540694 (32) 22.12.1995 (33) AU

(71) Applicant(s)
GLW Software Pty Limited

(Incorporated in Australia - Victoria)

Level 2,53 Queen Street, Melbourne, Victoria 3000, Australia

(72) Inventor(s)
Geoff Williams

(74) Agent and/or Address for Service
Kilburn & Strode
30 John Street, LONDON, WC1N 2DD, United Kingdom

(51) INT CL[6]
G06F 17/60

(52) UK CL (Edition O)
G4A AUXP

(56) Documents Cited
Dialog record 01207888 of Lotus, v3, n12, p143(19), Dec 1987

(58) Field of Search
UK CL (Edition O) G4A AUXP
INT CL[6] G06F 17/60
Online databases : COMPUTER, SOFTBASE, WPI

(54) Forecasting by use of spreadsheets

(57) This invention concerns a forecasting system which takes data and processes it to provide selective data reports 4 including forecasts as a continuum of past results. The system makes use of arrays 5,6 and in particular arrays embedded in computerised spreadsheets to process measured and forecast data and produce control reports. In particular the system produces a summary array 7 and a closing array 8 by adding together the other arrays. The invention is applicable to e.g. checking the behaviour of rocket fuel cells and forecasting resources available.

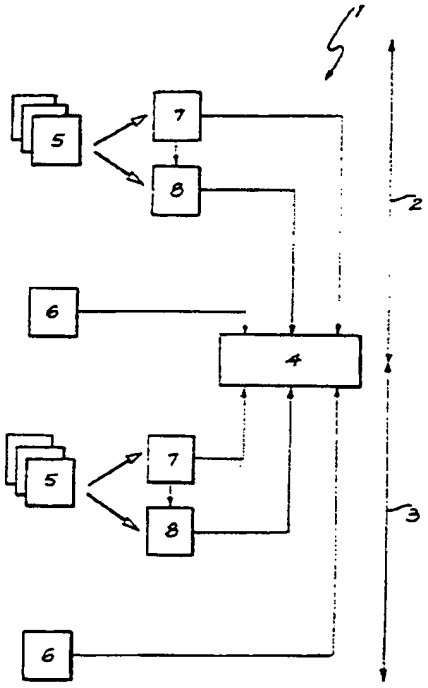

FIG. 1

GB 2 308 692 A

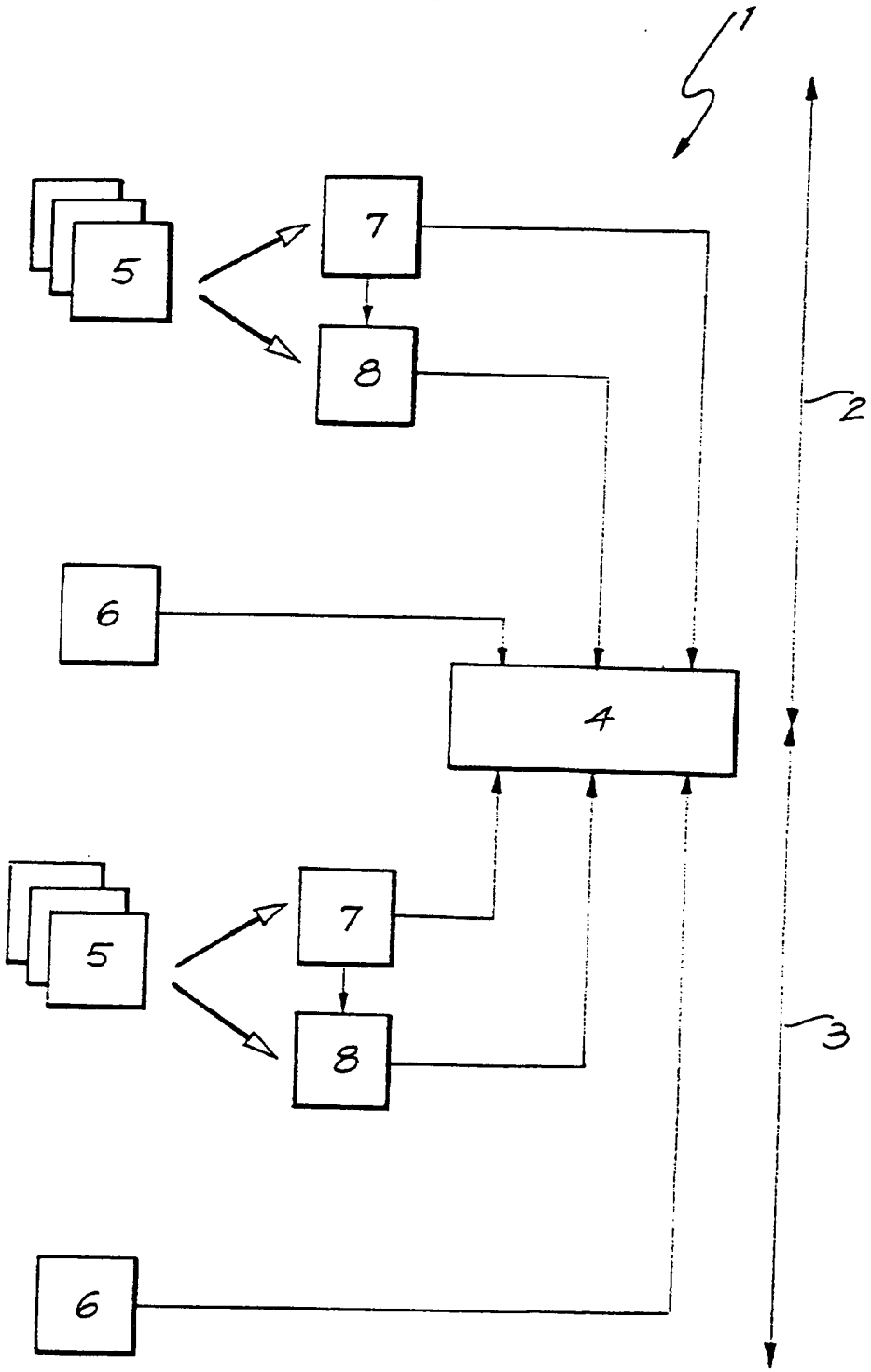

FIG. 1

Population Births during the Year

GROWTH ITEM () is increase/income for country	1986	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 FCAST	1993 FCAST	1994 FCAST	1995 FCAST	1996 FCAST	1997 FCAST
Births												
(Migration) to Australia		(240,883)	(246,883)	(250,455)	(254,088)	(250,230)	(263,115)	(268,073)	(270,864)	(274,787)	(278,743)	(282,732)
Deaths												
Permanent Departures												
Net Interstate Migration												
Statistical Errors												
ASSET CATEGORY: () is decrease in asset												
NSW		85,180	85,127	80,344	87,331	88,408	89,584	90,877	92,202	93,537	94,884	96,242
VIC		64,077	63,841	64,543	65,385	66,453	67,108	68,162	69,175	70,177	71,187	72,208
QLD		40,410	40,601	41,552	42,880	44,103	45,107	45,769	46,436	47,108	47,787	48,470
SA		21,201	21,147	21,327	21,555	21,835	22,109	22,433	22,760	23,090	23,422	23,758
WA		22,460	22,760	23,305	24,120	24,780	25,285	25,650	26,029	26,406	26,787	27,170
TAS		6,876	6,794	6,791	6,820	6,926	6,980	7,091	7,195	7,299	7,404	7,510
NT		2,378	2,370	2,360	2,365	2,386	2,410	2,445	2,481	2,517	2,553	2,590
ACT		3,087	4,036	4,142	4,217	4,325	4,455	4,520	4,586	4,653	4,720	4,787
CONTROL TOTAL		(0)	(0)	0	(0)	(0)	0	0	0	0	0	0
Birth Rate, per thousand based on populations end previous year		15	15	15	15	15	15	15	15	15	15	15

Sources: Commonwealth Year Book 1992: p182 mentions crude rate 15.4 per thousand given and apportioned over States

Fig. 2

Migration to Australia during the Year

GROWTH ITEM () is increase/income for country	1986	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL;	1990 ACTUAL	1991 ACTUAL	1992 FCAST	1993 FCAST	1994 FCAST	1995 FCAST	1996 FCAST	1997 FCAST
Births (Migration) to Australia Deaths Permanent Departures Net Interstate Migration Statistical Errors		(128,200)	(151,550)	(131,000)	(121,500)	(133,115)	(133,115)	(133,115)	(133,115)	(133,115)	(133,115)	(133,115)
ASSET CATEGORY: () is decrease in asset												
NSW		44,302	52,208	45,183	41,662	45,308	45,312	45,312	45,312	45,312	45,312	45,312
VIC		33,324	39,221	33,775	31,208	34,124	33,996	33,996	33,996	33,996	33,996	33,996
QLD		21,020	24,943	21,744	20,468	22,647	22,621	22,621	22,621	22,621	22,621	22,621
SA		11,073	12,001	11,160	10,288	11,212	11,185	11,185	11,185	11,185	11,185	11,185
WA		11,685	13,082	12,242	11,510	12,792	12,792	12,792	12,792	12,792	12,792	12,792
TAS		3,576	4,174	3,554	3,258	3,556	3,536	3,536	3,536	3,536	3,536	3,536
NT		1,237	1,480	1,235	1,120	1,225	1,210	1,210	1,210	1,210	1,210	1,210
ACT		2,074	2,480	2,168	2,013	2,221	2,254	2,254	2,254	2,254	2,254	2,254
CONTROL TOTAL		(0)	(0)	0	(0)	0	0	0	0	0	0	0

Sources: Commonwealth Year Book 1992: p175: Australian totals given and apportioned over States above pro-rata to population at end of previous year.
Data for 1991 onwards based on average of 1987-1990, then allocated pro-rata to States

Fig. 3

DEATH - Population Deaths during the Year

GROWTH ITEM () Is Increase/Income for country	1986	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 F'CAST	1993 F'CAST	1994 F'CAST	1995 F'CAST	1996 F'CAST	1997 F'CAST
Births (Migration) to Australia Deaths Permanent Departures Net Interstate Migration Statistical Errors		112,128	112,128	113,343	115,767	117,632	119,598	121,352	123,120	124,903	126,701	128,515
ASSET CATEGORY: () Is decrease in asset												
NSW		(38,721)	(38,604)	(39,247)	(39,606)	(40,186)	(40,711)	(41,308)	(41,910)	(42,517)	(43,129)	(43,746)
VIC		(29,126)	(29,010)	(29,338)	(29,720)	(30,206)	(30,544)	(30,992)	(31,443)	(31,899)	(32,358)	(32,821)
QLD		(18,372)	(18,455)	(18,887)	(19, 401)	(20,047)	(20,503)	(20,804)	(21,107)	(21,413)	(21,721)	(22,032)
SA		(9,676)	(9,612)	(9,694)	(9,798)	(9,925)	(10,050)	(10,197)	(10,346)	(10,495)	(10,647)	(10,799)
WA		(10,213)	(10,345)	(10,634)	(10,868)	(11,268)	(11,493)	(11,662)	(11,832)	(12,003)	(12,176)	(12,350)
TAS		(3,125)	(3,088)	(3,087)	(3,103)	(3,149)	(3,177)	(3,223)	(3,270)	(3,318)	(3,365)	(3,414)
NT		(1,081)	(1,080)	(1,073)	(1,075)	(1,085)	(1,095)	(1,111)	(1,128)	(1,144)	(1,160)	(1,177)
ACT		(1,812)	(1,835)	(1,833)	(1,917)	(1,960)	(2,025)	(2,055)	(2,085)	(2,115)	(2,145)	(2,176)
CONTROL TOTAL		0	(0)	(0)	(0)	0	0	(0)	(0)	(0)	(0)	0
Death Rate, per thousand based on populations end previous year		7	7	7	7	7	7	7	7	7	7	7

Sources: Commonwealth Year Book 1992: p162 mentions crude rate 7.0 per thousand given and apportioned over States above.

Fig. 4

Population Permanent Departures during the Year

GROWTH ITEM () Is Increase/Income for country	1986	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 FCAST	1993 FCAST	1994 FCAST	1995 FCAST	1996 FCAST	1997 FCAST
Births (Migration) to Australia Deaths Permanent Departures Net Interstate Migration Statistical Errors		20,410	20,320	24,830	30,370	23,083	23,083	23,083	23,083	23,083	23,083	23,083
ASSET CATEGORY: () Is decrease in asset												
NSW		(7,048)	(7,012)	(8,560)	(10,414)	(8,170)	(8,164)	(8,164)	(8,164)	(8,164)	(8,164)	(8,164)
VIC		(5,302)	(5,250)	(6,300)	(7,707)	(6,148)	(6,125)	(6,125)	(6,125)	(6,125)	(6,125)	(6,125)
QLD		(3,344)	(3,344)	(4,110)	(5,113)	(4,080)	(4,111)	(4,111)	(4,111)	(4,111)	(4,111)	(4,111)
SA		(1,702)	(1,742)	(2,114)	(2,570)	(2,020)	(2,015)	(2,015)	(2,015)	(2,015)	(2,015)	(2,015)
WA		(1,850)	(1,875)	(2,310)	(2,877)	(2,293)	(2,305)	(2,305)	(2,305)	(2,305)	(2,305)	(2,305)
TAS		(500)	(560)	(673)	(814)	(641)	(637)	(637)	(637)	(637)	(637)	(637)
NT		(197)	(190)	(234)	(282)	(221)	(220)	(220)	(220)	(220)	(220)	(220)
ACT		(330)	(332)	(411)	(503)	(400)	(400)	(406)	(406)	(406)	(406)	(400)
CONTROL TOTAL		(0)	0	0	0	(0)	(0)	(0)	(0)	(0)	(0)	(0)

Sources: Commonwealth Year Book 1992: p162 Australian totals given.
Apportioned over States above pro-rata to population at end of previous year.
Data for 1991 onwards based on average of 1987-1990, then allocated pro-rata to States

Fig. 5

Population Interstate Migration during the Year

GROWTH ITEM () is increase/income for country	1986	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 FCAST	1993 FCAST	1994 FCAST	1995 FCAST	1996 FCAST	1997 FCAST
(Births)												
(Migration) to Australia												
Deaths												
Permanent Departures												
Net Interstate Migration												
Statistical Errors		(100)	(100)	0	(100)	200						
ASSET CATEGORY: () is decrease in asset												
NSW												
VIC		(10,300)	(14,200)	(39,100)	(37,000)	(16,800)	0	0	0	0	0	0
QLD		(13,400)	(14,800)	(12,000)	(8,200)	(16,200)	0	0	0	0	0	0
SA		18,100	26,200	45,300	36,000	27,400	0	0	0	0	0	0
WA		(3,200)	(300)	800	700	3,100	0	0	0	0	0	0
TAS		10,400	6,400	9,500	7,100	2,500	0	0	0	0	0	0
NT		(2,800)	(3,400)	(1,300)	1,400	(200)	0	0	0	0	0	0
ACT		(1,400)	(4,600)	(3,000)	(2,000)	(2,200)	0	0	0	0	0	0
CONTROL TOTAL		2,700	2,800	700	2,100	4,200	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0

Source: Commonwealth Year Book 1992: p178 for Australian totals

Fig. 6

Statistical Errors during the Year

GROWTH ITEM () Is increase/income for country	1986	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 FCAST	1993 FCAST	1994 FCAST	1995 FCAST	1996 FCAST	1997 FCAST
(Births)												
(Migration) to Australia												
Deaths												
Permanent Departures												
Net Interstate Migration												
Statistical Errors		(2,435)	(8,050)	(52,000)	(22,088)	(220)	0	0	0	0	0	0
ASSET CATEGORY: () Is decrease in asset												
NSW		7,300	11,703	25,801	13,001	7,034						
VIC		(1,484)	(980)	9,858	7,403	(474)						
QLD		(5,053)	(2,945)	4,743	(2,881)	(4,707)						
SA		(8,121)	(8,383)	(5,088)	(5,701)	(6,611)						
WA		9,000	11,377	17,756	10,180	5,603						
TAS		(2,480)	(3,404)	(2,004)	(2,072)	(2,004)						
NT		1,310	1,232	1,168	1,417	1,396						
ACT		550	297	454	402	74						
CONTROL TOTAL		0	0	0	0	0	0	0	0	0	0	0

Fig. 7

Summary of Change Factors

GROWTH ITEM () Is Increase/Income for country	1986	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 FCAST	1993 FCAST	1994 FCAST	1995 FCAST	1996 FCAST	1997 FCAST
(Births)		(240,883)	(240,883)	(250,455)	(254,088)	(250,230)	(263,115)	(266,073)	(270,864)	(274,787)	(278,743)	(282,732)
(Migration) to Australia		(128,200)	(151,550)	(131,080)	(121,500)	(133,115)	(133,115)	(133,115)	(133,115)	(133,115)	(133,115)	(133,115)
		0	0	0	0	0	0	0		0	0	0
Deaths		112,128	112,128	113,843	115,707	117,832	119,598	121,352	123,120	124,003	126,701	128,515
Permanent Departures		20,410	20,320	24,830	30,370	23,083	23,083	23,083	23,083	23,083	23,083	23,083
Net Interstate Migration		(100)	(100)	0	(100)	200	0	0	0	0	0	0
Statistical Errors		(2,435)	(6,050)	(52,000)	(22,088)	(220)	0	0	0	0	0	0
NET CHANGE: () = (PROFIT)		(244,080)	(274,834)	(204,032)	(252,208)	(250,550)	(252,050)	(254,754)	(256,877)	(259,017)	(261,174)	(263,350)
ASSET CATEGORY: () Is decrease in asset												
NSW												
VIC												
QLD												
SA												
WA												
TAS												
NT												
ACT												
CONTROL TOTAL												

Fig. 8

Closing Total Population at End of Year

GROWTH ITEM () Is Increase/Income for country	1986	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 FCAST	1993 FCAST	1994 FCAST	1995 FCAST	1996 FCAST	1997 FCAST
(Births)	.	.	.	.	.	.	.	.	.	.	.	.
(Migration) to Australia	.	.	.	.	.	.	.	.	.	.	.	.
Deaths	.	.	.	.	.	.	.	.	.	.	.	.
Permanent Departures	.	.	.	.	.	.	.	.	.	.	.	.
Net Interstate Migration	.	.	.	.	.	.	.	.	.	.	.	.
Statistical Errors	.	.	.	.	.	.	.	.	.	.	.	.
NET CHANGE: () =(PP	.	.	.	.	.	.	.	.	.	.	.	.
PREVIOUS INVESTM	0	(244,969)	(274,834)	(294,932)	(252,298)	(250,550)	(252,050)	(254,754)	(256,877)	(259,017)	(261,174)	(263,350)
	(16,018,350)	(16,018,350)	(16,263,319)	(16,538,153)	(16,833,085)	(17,085,383)	(17,335,033)	(17,588,583)	(17,843,337)	(18,100,214)	(18,359,230)	(18,620,404)
ASSET CATEGORY												
NSW	5,531,526	5,612,244	5,701,525	5,771,046	5,826,850	5,901,126	5,987,128	6,073,840	6,161,286	6,249,455	6,338,358	6,428,002
VIC	4,160,856	4,208,946	4,261,945	4,321,484	4,379,822	4,427,371	4,491,894	4,550,955	4,622,558	4,688,708	4,755,408	4,822,664
QLD	2,624,595	2,676,765	2,743,705	2,834,007	2,906,778	2,972,004	3,015,317	3,058,091	3,103,029	3,147,434	3,192,209	3,237,356
SA	1,382,550	1,394,154	1,408,255	1,424,947	1,439,121	1,450,712	1,477,042	1,499,346	1,520,933	1,542,698	1,564,644	1,586,773
WA	1,459,019	1,500,507	1,544,800	1,594,745	1,633,825	1,665,045	1,680,224	1,714,705	1,739,301	1,764,282	1,789,380	1,814,687
TAS	446,473	447,941	448,457	451,138	456,633	460,465	467,176	473,942	480,765	487,645	494,582	501,577
NT	154,421	156,674	155,660	156,323	157,277	158,779	161,093	163,426	165,779	168,151	170,543	172,955
ACT	258,910	266,088	273,534	278,705	285,077	293,531	297,809	302,122	306,472	310,857	315,280	319,739
CONTROL TOTAL	0	0	0	0	0	0	0	0	0	0	0	0

Fig. 9

Total Population at year end

1992 YEARBOOK DATA	1986	1987 ACTUAL	1988 ACTUAL	1989 ACTUAL	1990 ACTUAL	1991 ACTUAL	1992 FCAST	1993 FCAST	1994 FCAST	1995 FCAST	1996 FCAST	1997 FCAST
Total Population year end		16,203,310	16,538,153	16,833,085	17,085,383	17,335,933	17,588,583	17,843,337	18,100,214	18,359,230	18,620,404	18,883,755
							ACTUAL	ACTUAL	ACTUAL	FCAST	FCAST	FCAST
1996 YEARBOOK DATA:							17,469,072	17,850,427	17,843,208	18,041,891	18,242,871	18,445,627
Errors							99,511	180,910	250,946			
Errors %							0.57%	1.00%	1.44%			

Fig. 9a

PROFIT & LOSS ENTRIES	JULY ACTUAL	AUGUST ACTUAL	SEPT. FORECAST	OCTOBER FORECAST	NOV FORECAST	DECEMBER FORECAST	JANUARY FORECAST	FEBRUARY FORECAST	MARCH FCAST	APRIL FCAST	MAY FCAST	JUNE FCAST
REVENUE												
Sales	(102,400)	(105,600)	(80,000)	(80,000)	(76,800)	(48,000)	(10,000)	(28,800)	(48,000)	(51,200)	(73,600)	(89,600)
Other Income												
COST OF SALES												
Opening Stock												
Purchases												
Rent												
Wages												
Closing Stock												
OFFICE EXPENSES												
Depreciation												
Insurance & Workcare												
Leave												
Light & Power												
Petty Cash & Sundry												
Wages												
Income Tax												
BALANCE SHEET ENTRIES												
CURRENT ASSETS												
Cash at Bank	102,400	105,600	80,000	80,000	76,800	48,000	10,000	28,800	48,000	51,200	73,600	89,600
Debtors												
Provision Doubtful Debts												
Closing Stock - Products												
NON-CURRENT ASSETS												
Depreciation Provision												
Investments at cost												
CURRENT LIABILITIES												
Trade Creditors												
Provision for Income Tax												
NON-CURRENT LIABILITIES												
Mortgage												
SHAREHOLDERS EQUITY												
Share Capital												
Profit Current Year after tax	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS												

Fig. 10

PROFIT & LOSS ENTRIES	JULY ACTUAL	AUGUST ACTUAL	SEPT. FORECAST	OCTOBER FORECAST	NOV FORECAST	DEC FORECAST	JANUARY FORECAST	FEBRUARY FORECAST	MARCH FORECAST	APRIL FORECAST	MAY FORECAST	JUNE F'CAST
REVENUE												
Sales												
Other Income												
COST OF SALES												
Opening Stock												
Purchases												
Rent												
Wages												
Closing Stock												
OFFICE EXPENSES												
Depreciation	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Insurance & Workcare												
Leave												
Light & Power												
Petty Cash & Sundry												
Wages												
Income Tax												
BALANCE SHEET ENTRIES												
CURRENT ASSETS												
Cash at Bank												
Debtors												
Provision Doubtful Debts												
Closing Stock - Products												
NON-CURRENT ASSETS												
Fixed Asset Depreciation Provision	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)
Provision for Income Tax												
CURRENT LIABILITIES												
Trade Creditors												
Provision for Income Tax												
NON-CURRENT LIABILITIES												
Mortgage												
SHAREHOLDERS EQUITY												
Share Capital												
Profit Current Year after tax												
TOTALS	0	0	0	0	0	0	0	0	0	0	0	0

Fig. 11

PROFIT & LOSS ENTRIES	JULY ACTUAL	AUGUST ACTUAL	SEPT FORECAST	OCTOBER FORECAST	NOV FORECAST	DECEMBER FORECAST	JANUARY FORECAST	FEBRUARY FORECAST	MARCH FORECAST	APRIL FCAST	MAY FORECAST	JUNE FCAST
REVENUE												
Sales	(102,400)	(105,000)	(80,800)	(80,000)	(76,800)	(48,000)	(40,000)	(28,800)	(48,000)	(51,200)	(73,600)	(80,800)
Other Income	-	-	-	-	-	-	-	-	-	-	-	-
COST OF SALES												
Opening Stock	-	-	-	-	-	-	-	-	-	-	-	-
Purchases	-	-	-	-	-	-	-	-	-	-	-	-
Rent	-	-	-	-	-	-	-	-	-	-	-	-
Wages	-	-	-	-	-	-	-	-	-	-	-	-
Closing Stock	-	-	-	-	-	-	-	-	-	-	-	-
OFFICE EXPENSES												
Depreciation	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Insurance & Workcare	-	-	-	-	-	-	-	-	-	-	-	-
Leave	-	-	-	-	-	-	-	-	-	-	-	-
Light & Power	-	-	-	-	-	-	-	-	-	-	-	-
Petty Cash & Sundry	-	-	-	-	-	-	-	-	-	-	-	-
Wages	-	-	-	-	-	-	-	-	-	-	-	-
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-
BALANCE SHEET ENTRIES												
CURRENT ASSETS												
Cash at Bank	-	-	-	-	-	-	-	-	-	-	-	-
Debtors	-	-	-	-	-	-	-	-	-	-	-	-
Provision Doubtful Debts	-	-	-	-	-	-	-	-	-	-	-	-
Closing Stock - Products	-	-	-	-	-	-	-	-	-	-	-	-
NON-CURRENT ASSETS	-	-	-	-	-	-	-	-	-	-	-	-
Fixed Asset Depreciation Provision	-	-	-	-	-	-	-	-	-	-	-	-
Investments at cost	-	-	-	-	-	-	-	-	-	-	-	-
CURRENT LIABILITIES	-	-	-	-	-	-	-	-	-	-	-	-
Trade Creditors	-	-	-	-	-	-	-	-	-	-	-	-
Provision for Income Tax	-	-	-	-	-	-	-	-	-	-	-	-
NON-CURRENT LIABILITIES												
Mortgage	-	-	-	-	-	-	-	-	-	-	-	-
SHAREHOLDERS EQUITY												
Share Capital	-	-	-	-	-	-	-	-	-	-	-	-
Profit Current Year after tax	(101,400)	(104,600)	(88,800)	(79,000)	(75,800)	(47,000)	(15,000)	(27,800)	(47,000)	(50,200)	(72,600)	(88,600)
TOTAL	-	-	-	-	-	-	-	-	-	-	-	-

Fig. 12

PROFIT & LOSS ENTRIES	JUNE ACTUAL	JULY ACTUAL	AUGUST ACTUAL	SEPT FCAST	OCT FCAST	NOV FCAST	DEC FCAST	JANUARY FCAST	FEB FCAST	MARCH FCAST	APRIL FCAST	MAY FCAST	JUNE FCAST
REVENUE													
Sales													
Other Income													
COST OF SALES													
Opening Stock													
Purchases													
Rent													
Wages													
Closing Stock													
OFFICE EXPENSES													
Depreciation													
Insurance & Workcare													
Leave													
Light & Power													
Petty Cash & Sundry													
Wages													
Income Tax													
BALANCE SHEET ENTRIES													
CURRENT ASSETS													
Cash at Bank	200,000	302,400	408,000	497,600	517,800	654,400	702,400	718,400	747,200	795,200	806,400	920,000	1,004,600
Debtors													
Provision Doubtful Debts													
Closing Stock - Products													
NON-CURRENT ASSETS													
Fixed Asset	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000
Depreciation Provision	(10,000)	(11,000)	(12,000)	(13,000)	(14,000)	(15,000)	(16,000)	(17,000)	(18,000)	(19,000)	(20,000)	(21,000)	(22,000)
Investments at cost													
CURRENT LIABILITIES													
Trade Creditors													
Provision for Income Tax													
NON-CURRENT LIABILITIES													
Mortgage													
SHAREHOLDERS EQUITY													
Share Capital	(300,000)	(300,000)	(300,000)	(300,000)	(300,000)	(300,000)	(300,000)	(300,000)	(300,000)	(300,000)	(300,000)	(300,000)	(300,000)
Profit Current Year after tax	-	(101,400)	(200,000)	(284,600)	(373,600)	(449,400)	(490,400)	(511,400)	(539,200)	(586,200)	(236,400)	(709,000)	(797,600)
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

Fig. 13

"A FORECASTING CONTROL SYSTEM AND METHOD"

Technical Field

This invention concerns a forecasting control system which takes measured data, and processes it to provide selective data reports including forecasts. The system makes use of arrays, and in particular arrays embedded within computerised spreadsheets, to process the data and provide the reports. In further aspects the invention concerns a method of operating the computerised spreadsheets and a computer system.

Background Art

The invention comprises a framework for efficiently generating and controlling forecasts from historical data, and arose in financial forecasting originally. With the advent of personal computers, a number of forecasting packages have been introduced. A typical accountancy package will provide for sequential entry of historical accountancy data, and a computing "engine" will process this data to provide accountancy output, which is compared with a budget. The "engine" will generally be invisible to the user, and its operation need not be understood by the user. In fact, it is commonly the case that the user will not be able to determine how the "engine" is processing the accountancy data to produce the output. Some systems, in an endeavour to reduce the ability of users to tamper with the input data, restrict users ability to change data once entered. These packages tend to be inflexible in their provision of reports, do not usually provide any forecasting facilities, and do not have provision to include technical non-accounting data. Other packages concentrate on forecasting, with minimal or no historical data. Yet other spreadsheet systems are developed to forecast results for companies for economic investment appraisals, but do not include basic accounting controls such as double-entry bookkeeping, applied to forecasts.

Disclosure of the Invention

The present invention provides a forecasting control system comprising: arrays of cells for the entry of data items representing operational, historical and forecast data for each of a number of defined reporting periods within a time period; wherein each cell in each array corresponds to a particular item of growth or category of assets in respect of a particular reporting period; some of the arrays are designated data entry arrays and data concerning different items of growth are entered into

different data entry arrays, each cell of a summary of change factors array is arranged to automatically display data which is the sum of the data entered for the respective item of growth and for the respective reporting period on all the data entry arrays; and each cell of a closing array automatically displays data which is the sum of: the data entered for the respective category of asset and the respective reporting period on all the other arrays; plus the value of the respective cell of the closing array in the immediately preceding reporting period. A note on the terms used is indicated on Annexure A of this application.

The array approach allows the user to define and select in advance the data to be tracked by the system. Both historical data such as particular revenue, expenses, equity, assets and liabilities, and operational data such as measurable technical features of transactions with major groups such as customers, workers, and suppliers, may be entered.

The arrays may be partitioned into sections, each array having a growth factor section and a system status section. Alternatively, separate arrays may be provided for growth factor data, and for system status data, and these arrays may be paired.

Columns in the arrays may record data for reporting periods preselected by the user within a time period, for example the twelve months July to June of a financial year in accounting applications; or the ten years 1990 to 2000 in economic appraisals.

Rows in the arrays may record items of data, for example: sales, purchases, fixed asset totals, creditor totals or other data, and units sold, labour hours worked, orders delivered late or other non-financial data.

Any entry for a particular reporting period may require both a positive value such as a debit for an expense or asset, and a negative value such as a credit for income or a creditor, to be entered in the same column. The action of this control is shown in a check row to clarify that entries in a particular reporting period total zero, or in other words that total debits equal total credits.

The arrangement preserves double-entry bookkeeping, with which bookkeeping staff are familiar, and allows data to be entered by staff without advanced qualifications. The data is easily reviewed from period to period by qualified personnel.

Additional columns may be added to show, for instance, year-to-date actuals, and forecast end-term results.

A summary of change factors (or profit) array may be derived by formulae which automatically sum items affecting profit or change from data input arrays over the defined reporting periods. The total profit or net change for each month may be recorded in a special profit row in the array.

A summary system status or closing (balance sheet) array may be derived by formulae which automatically sum the status or asset and liability items, plus the opening value of these items at the beginning of each reporting period, plus the total profit derived from the profit array.

Budget data, set at the beginning of the accounting period, actual data recorded during the accounting period and forecast data may be treated in similar ways.

Before a forecasting exercise is started, a budget array is completed showing budget data for each reporting period.

Another array is there, filled with forecast data for each reporting period, showing expected data rather than target or budget data. Actual data is then entered in place of forecast data, as each reporting period is completed. A close relationship of actual and forecast data is maintained. At the beginning of the accounting period, the forecasts may be close to budget, but after a month or two forecasts may differ substantially from budget. This will indicate to management that results for the full year may be substantially above or below original budget, and provides early warning to management to take action to avoid adverse results. By including forecasts, the effect of action by management, such as a decision to raise prices by 10%, can be obtained to determine whether the action proposed will yield the desired result.

The forecasts may be revised in the light of each month's actual results, every month. The forecasts will therefore reflect the most up-to-date information. The forecasts of each item grow naturally out of, and can be seen to be consistent with, the immediately preceding data. Furthermore, the forecast data is subject to the same data controls as actual data. For financial data, a forecast balance sheet is generated for every reporting period in advance, and this forecast balance sheet must balance, as does a balance sheet with historical data. For non-financial data, causal factors are specified

and separately forecast, and actual data for the causal factors isolated is reconciled with total system data by an error array.

Another advantage is reversibility. This may be particularly important in analysis of financial statements of public companies. An analyst will not know in advance all the causal factors, that is the accounting transactions which cause the changes in balance sheets. However, from the balance sheets available in summary form, the causal changes may be deduced by disaggregating the data back into individual data arrays for respective items.

The technique of adding and subtracting arrays of data is a general technique that can work in either direction: from the system "balance sheet" to causal factors, or from causal factors to a system "balance sheet".

Reports may be defined by the user. These may be combinations of summary data, comparing budget, actual and forecast data, and comments and graphs as desired. For example, a graph may plot budget levels of cash at bank month by month, and compare these with plots of actual cash at bank each month to date, and forecast cash at bank levels for the remainder of the year. Financial data and non-financial data may be highlighted in the reports as preferred by the user.

The system described can be implemented in a computerised spreadsheet application. In this case each set of revenue and expense and balance sheet data may be placed on a respective page within the spreadsheet. The cells of the sheets may contain formulae linked to the contents of other cells. In particular, some cells in journal arrays may contain formulae which reverse entries made in other revenue or expense cells. In addition, the cells of the closing profit array and the final balance sheet array may contain formulae to add the contents of the respective cells of the other arrays.

In another aspect, the invention provides a forecasting control method comprising the steps of:

displaying a plurality of data entry arrays containing cells for the entry of data representing growth and asset items for each of a number of defined reporting periods within a time period, wherein each cell in each data entry array corresponds to a particular item of growth or category of assets in respect of a particular reporting period;

entering items, historical or forecast, concerning different growth and assets data in the cells of different data entry arrays;

displaying a summary of change factors array in which each cell automatically contains the sum of the data entered for defined items of growth and respective reporting periods on all the data entry arrays; and

displaying a closing array in which each cell automatically contains the sum of: data entered for the defined category of asset and reporting period on all the other sheets plus the value of the respective cell of the closing array in the immediately preceding reporting period.

In a further aspect the invention provides a method of operating a computer spreadsheet application to provide forecasting control comprising the steps of: constructing a plurality of arrays each having the same corresponding elements in which there is identified the same item of growth or category of assets in respect of the same reporting period;

designating one of the arrays as a summary of change factors array and inserting a formula into each growth factor cell to automatically calculate the sum of the entries in the corresponding cell in each of the other arrays;

designating another array as a closing array and inserting a formula into each asset cell to automatically calculate the sum of the entries in the corresponding cell of each of the other arrays plus in the first reporting periods an opening value and in the subsequent reporting periods the value of the respective cell of the closing array in the immediately preceding reporting period.

In a further aspect the invention provides a computer system including a spreadsheet application arranged to provide forecast control comprising a plurality of arrays each having the same corresponding elements in which there is identified the same item of growth or category of assets in respect of the same reporting period;

one of the arrays is a summary of change factors array in which there is a formula in each growth factor cell to automatically calculate the sum of the entries in the corresponding cell in each of the other arrays;

another array is a closing array in which there is a formula in each asset cell to automatically calculate the sum of the entries in the corresponding cell of each of the other arrays plus the value of the respective cell of the closing array in the immediately preceding reporting period.

In a further aspect the invention provides computer software to control the operation of a computer spreadsheet application to perform the method of operating a computer spreadsheet application to provide forecasting control reports, comprising the steps of: constructing a plurality of arrays, each having the same corresponding elements in which there is identified the same item of growth or category of assets in respect of the same reporting period;

designating one of the arrays as a summary of change factors array. and inserting a formula into each growth factor cell to automatically calculate the sum of the entries in the corresponding cell in each of the other arrays;

designating another array as a closing array, and inserting a formula into each asset cell to automatically calculate the sum of the entries in the corresponding cell of each of the other arrays, plus the value of the respective cell of the closing array in the immediately preceding reporting period.

Brief Description of the Drawings:

Examples of the invention will now be described with reference to the accompanying drawings.

Figure 1 is a schematic diagram outlining a prepared embodiment of the invention.

Figures 2 to 9 concern a first example showing the application of the invention to records of the Australian population:

Figure 2 is an array of population births:

Figure 3 is an array of migrations to Australia:

Figure 4 is an array of population deaths;

Figure 5 is an array of permanent departures;

Figure 6 is an array of net interstate migration;

Figure 7 is an array of statistical errors;

Figure 8 is an array of the sum of change factors; and

Figure 9 is an array showing population at the close of each year.

Figure 9a shows the total population at year end.

Figures 10 to 13 concern a second example applied in an accounting scenario:

Figure 10 is an array of cash receipts;

Figure 11 is an array of journal entries;

Figure 12 is an profit and loss statement: and

Figure 13 is an balance sheet.

Best Mode for Carrying out the Invention

Referring first to Figure 1 the reporting system 1 has a structure comprising two identically structured sub-systems 2 and 3 feeding information to the reports 4. The first sub-system 2 concerns budget data, and the second sub-system 3 concerns actual and forecast data.

In both sub-systems 2 and 3 there are data entry arrays 5 and 6. Economic data is entered into arrays 5 and operational data is entered into arrays 6. Change factor data and system status data both go into arrays 5. There are multiple arrays 5 each having the same dimensions, and concerning the same reporting periods and data. Data entry is disaggregated by entering different economic data items into different sections of the arrays 5. Arrays 5 are summed to produce a summary of change factors in array 7, and a final asset status summary in array 8. Operational data is shown as feeding direct to reports 4; however operational data may also be split into change factor data and system status data in the same way as the economic data. Arrays 6, 7 and 8 feed to reports 4.

In accounting applications, financial and non-financial data is input to arrays 5 and 6 respectively. The non-financial data input array 6 feeds direct to the reports 4. The financial data input arrays 5 are summed to produce a summary array 7 of profit, and another summary array 8 of closing balance sheets.

In both cases, the principles of double entry bookkeeping are applied to ensure an important control over the data, for each reporting period:

Array 8 of data in previous period (ie, opening balances for this reporting period).	+	Array 7 of data, for the current reporting period.	=	Array 8 data in this reporting period, (ie, closing balances).

It is not difficult using formulae to generate forecasts; application of this control however requires the forecasts to be generated in such a manner that the system is balanced. This enhances the reliability, consistency and verisimilitude of the forecasts. If asset acquisitions are forecast or budgeted, for example, the system requires liabilities (or diminution in cash reserves) to be also forecast or budgeted in exactly equal amounts, or error messages will be generated.

In a first example the population of Australia between 1986 and 1991 will be recorded and processed in order to provide forecasts for the population through 1992 to 1997. The base data is given in Table 1.

TABLE 1

KNOWN POPULATION AT END OF PERIOD

	1986	1987	1988	1989	1990	1991
NSW	5531526	5612244	5701525	5771946	5826850	5901126
VIC	4160856	4208946	4261945	4321484	4379822	4427371
QLD	2624595	2676765	2743765	2834097	2906778	2972004
SA	1382550	1394154	1408255	1424647	1439121	1456712
WA	1459019	1500507	1544806	1594745	1633825	1665945
TAS	446473	447941	448457	451138	456633	460465
NT	154421	156674	155866	156323	157277	158779
ACT	258910	266088	273534	278705	285077	293531
TOTAL AUSTRALIA	16018350	16263319	16538153	16833085	17085383	17335933

Source: Commonwealth Year Book 1992: p150

Figures 2 to 9 are set out showing data for the years 1986 to 1997 in columns. The first six rows show growth items. The following eight rows show a breakdown according to states and territories. The ninth row shows a control total which should sum the column to zero, and a final row present on some sheets shows a rate based on the population at the end of the preceding year.

Figure 2 deals with population births during the year. In the first row the actual birth figures are inserted for the years 1987 to 1991 and the breakdown of these figures by states and territories is set out lower down in the same columns. Forecasts are then made for the years 1992 to 1997 on the basis of the birth rate established from the historical data.

Figure 3 deals with migration to Australia and again the actual figures are entered from 1987 to 1991. For 1992 to 1997 the forecast is for migration at the 1991 rate.

Figure 4 deals with deaths. The actual figures are placed for 1987 to 1991 and the forecast figures are generated using the death rate of the historical figures.

Figure 5 deals with permanent departures. Historical data is entered from 1987 to 1991 and forecasts are made at a constant rate of departure for 1992 to 1997.

Figure 6 shows the net interstate migration and although this has not been forecasted the overall effect on the country's population is effectively zero for all years.

Figure 7 shows the statistical errors in the historical data.

Figure 8 is a summary of the change factors. This summary shows the growth items taken from Figures 2 to 7 and displayed in an array in corresponding location to those occupied in the earlier figures. It can be considered as a consolidation of Figures 2 to 7 and may be derived by adding the corresponding growth items of Figures 2 to 7 together and displaying them. An additional line is entered beneath the table of growth items showing the net change throughout the year.

Figure 9 is a snap shot of the total population at the end of each year. It shows the actual and forecast breakdown of the population into the various states and territories. This array also shows the 1986 values and the net change row from Figure 8. The previous year's population can be added to the total population at the end of the preceding year shown in the row labelled "Previous Investment" in order to arrive at a total population figure for the year end. The total population figure for the year end is not shown in Figure 9 but is shown in Figure 9a.

Figure 9a also shows the actual and forecast population figures from the 1996 year book and this data has been used to test the forecast populations and illustrates these by total error and percentage error.

An alternative way of forecasting the data is to apply a simple regression to the total population figures as shown in Table 2. The errors shown using this aggregated approach indicate higher errors than the forecasting which embodies the present invention. This does not say that the matrix disaggregation approach of the present invention will always yield better results than regression formulae.

TABLE 2

REGRESSION FORECASTS

YEAR	1992	1993	1994
1996 Year Book Data	17489076	17656427	17843268
Regression Forecasts	17618912	17888158	18157404
Errors	129840	231731	314136
Error %	0.74%	1.31%	1.76%

A second example will now be described with reference to Figures 10 to 13.

The arrangement of the data in arrays and in particular the separation of the data into growth factors and asset categories is compliant with standard double counting bookkeeping practice. This makes the invention particularly suited to accountancy applications.

Figure 10 shows an array of twelve columns each headed by the name of a month from July to June. The rows show growth factors as profit and loss entries divided into revenue and expenses and the system status categories as balance sheet entries divided into assets liabilities and equity. There is a totals row at the bottom of the page.

Data is credited (negative figures in brackets indicate a credit) into the row representing sales in the profit and loss array and the corresponding debit entry is made in the cash at bank row on the balance sheet array for cash sales. The total row at the bottom shows zero entries as a check.

The first two columns July and August are sub-headed actual and the data in these columns is actual data from subsidiary records maintained by bookkeepers. The remaining columns are sub-headed forecast and include data which is estimated.

Figure 11 shows an array which is identical in layout to Figure 10 but which has different entries. The entries on this array are journal entries and represent depreciation. Depreciation is debited as an expense in the profit section and credited representing an addition to the provision or diminution in value of the fixed assets in the balance sheet section. Again the entries for each month total to zero.

Figure 12 again shows identical arrays to Figures 10 and 11 but the data shown in the cells of the profit and loss array is the sum of all the data shown in the respective cells of the profit and loss arrays of Figures 10 and 11. Entries are automatically generated in the profit row equal to the sum of the other rows.

Figure 13 is again an array of identical layout but data is only shown in this case in the balance sheet section. An additional column is provided on the left hand side of the array for the opening values. The values in the first column of the array that is July represent the sums of the corresponding values in all the preceding sheets added to the opening values. The sums shown in the second column August are the sums from the corresponding

locations in all the preceding sheets but in addition they are added to the preceding month values (July). The process is continued across the array. The profits shown in the profit row in the profit and loss statement Figure 12 are also input onto the balance sheet.

An identical set of arrays could be provided for budget data.

Realisation

In a practical example a business entity finds through experience that certain journals are required to record accounting transactions: a sales journal, a purchases journal, a cash receipts journal, a cash payments journal, a general journal, for example. Let n=the number of journals required for a particular business entity.

Then consider a matrix A of 3 dimensions; this may be visualised as a spreadsheet consisting of (n+2) sheets. The first n sheets contain the journals required by the business entity.

Sheet (n+1) contains an array of profit data.

Sheet (n+2) contains an array of balance sheet data.

In general terms let A(s i j) denote an element of matrix A corresponding to sheet s account i period j. For example in an entity with 5 basic journals (n=5) the matrix A or spreadsheet can take the following form:

s=1: Sales journal data
s=2: Purchases journal data
s=3: Cash receipts journal data
s=4: Cash payments journal data
s=5: General journal data
s=6: Profit statement
s=7: Balance sheet

where i denotes an account number in the entity's chart of accounts and j denotes a month number in the current accounting period (financial year) of 1 2 3.....12.

The journal matrices may be partitioned matrices containing profit data and balance sheet data in separate sections.

The profit statement on sheet (n+1) is derived by adding the profit data in the first n sheets for any particular month j:

$$A(n+1\ i\ j) = \sum_{s=1}^{n} A(s\ i\ j)$$

for i=revenue or expense account.

The profit is found by adding all entries i for that month j in the profit statement and recording the sum in a special row p:

$$A(n+1\ p\ j) = \sum_{i \neq p} A(n+1\ i\ j)$$

p is conveniently located as a row in the equity section.

The balance sheet on sheet (n+2) is derived by adding the balance sheet data in the first n sheets for any particular month j together with the corresponding balances of the previous month:

$$A(n+2\ i\ j) = \sum_{s=1}^{n} A(s\ i\ j) \quad + \quad A(n+2\ i\ j\text{-}1)$$

for balance sheet accounts $i \neq p$

The invention also postulates that the profit for the current month found in the profit statement is added in to the equity in the balance sheet statement:

$$A(n+2\ p\ j) = A(n+2\ p\ j\text{-}1) + A(n+1\ p\ j).$$

If all accounting entries are correct then the data in the balance sheet in each month j will sum to zero:

$$\sum_{i} A(n+2\ i\ j) = O$$

for j= 1 2....12.

Whatever the current month say j=t. This means that both actual and forecast data are subject to the same overall control: total debits are

balanced with total credits whether they are historical debits and credits or future debits and credits. The advantage of this feature in forecasting is that it is a check to ensure that liabilities are not omitted. Only by including all forecast liabilities will a forecast balance sheet balance.

It is important to ensure that in the arrays s=1 2...n recording journal data input that the sum of all entries to all accounts in any month j will add to zero. This summation to zero is obtained on the journal input matrices by entering the complete accounting entry for each entry each month: that is ensuring total debits equal total credits. This is a useful control measure in its own right but also ensures matrices can be added together to yield a profit statement and a balance sheet.

Full year results are anticipated by inclusion of forecasts in each data cell for each account each month up to the end of the year on the same double entry accounting principle as for actual results.

Forecast Profit to year-end $\sum_{j=1}^{12} A(n+1pj)$ is found by summing actual profits for months 1 2....t plus forecast profits for months (t+1) (t+2)...12.

Forecast balance sheet data is obtained in a similar way by summing actual data in month t plus forecast data for months (t+1) (t+2)...12.

Forecast data is therefore subject to the same data control as actual data.

This logic is equally applicable to budget data:

A budget profit statement is obtained at the beginning of a year by adding budget journal matrices for revenue/expense accounts.

A budget balance sheet is obtained at the beginning of a year by adding budget journal matrices for asset/liability/equity accounts.

A report to management is obtained by comparing key budget and actual/forecast data:

Current month:	Actual results and budget results
Year to date:	Actual results and budget results
End Year:	Actual results for the first t months plus forecast results for the remaining (12-t) months for the full year compared to full year budget results.

A slight variation entails set-up of a matrix to hold opening balances on accounts at the beginning of each month; the profit statement could be held on sheet n+2 and the balance sheet held on sheet n+3.

Then $A(1\ i\ j) = A(n+3\ i\ j-1)$ for $j = 2\ 3 \ldots 12$

and $A(1\ i\ 1)$ has data input from the previous financial year.

Other variations may involve for example additional cash receipts and cash payments sheets/ matrices for additional bank accounts.

Also all matrices may be partitioned and the profit statement and balance sheet combined on one sheet which could be called a trial balance matrix.

Application to Annual Reporting:

Another application is to annual results comparing annual actuals with a long term plan for a defined period of t years as budget:

For example a planning cycle or term of t=5 years:

	1	2	3	4	5	years
Profits						**Total**
Budget	100	120	135	130	150	635
Actual	110	95				205
Forecast			90	95	105	290

In this case $j = 1\ 2\ 3\ 4\ 5$

In general:

Each year within the planning term of t years:

Compare actual results and budget results for each year

But also: Compare (a) the sum of actual results for the first j years and forecast results for the remaining (t-j) years of the planning term or cycle; with (b) the planned or budget results for all t years of the planning term or cycle

Even though the invention has been described with reference to particular embodiments it should be appreciated that it may be embodied in many other ways. For instance it is not necessary for the arrays to be identical nor for them to be positioned in the same places on respective sheets since it is possible to add elements from different arrays together regardless of their positions. However it is convenient and advantageous to the user to employ that arrangement. Error messages may also be provided to highlight any errors in data input or forecasts, in order to flag new trends or input errors. The source of all data changes could also be identified and recorded.

Industrial Applicability

Although the invention has been described with reference to applications which are not technical in themselves, it is possible to apply the invention technically. The invention could be employed in the many different control systems such as:

FORECASTING OF MINERAL RESOURCES

Objective:	Forecast specified mineral reserves, Australia 1997-2005
System status categories:	Estimated reserves at specified locations
System change categories:	Production, destruction, evaporation, wastage
Unit of measurement:	Kilotonnes or megalitres

FORECASTING OF BIOLOGICAL RESOURCES

Objective:	Forecast (eg) Australian forest resources, 1997-2005
System status categories:	Estimated reserves of different species of trees on Australian commercial plantations
System change categories:	Sawmilling, destruction by fire, planting, additions purchased, relinquishments
Unit of measurement:	Hectares

FORECASTING OF MILITARY RESOURCES

Objective:	Forecast (eg) Australian army personnel, 1997-2000
System status categories:	Numbers of personnel of different ranks and different training at different locations
System change categories:	Recruitments, killed, resignations, promotions, transfers
Unit of measurement:	Number of personnel

FORECASTING OF A CITY OFFICE SPACE

Objective:	Forecast (eg) stock of office space, Melbourne 1997-2000
System status categories:	Office space in 6 city areas defined by the Building Owners & Managers Association
System change categories:	Supply additions, vacant, withdrawals
Unit of measurement:	Square metres

FORECASTING OF VEHICLE FUEL USAGE

Objective:	Forecast (eg) fuel consumption for a satellite launch rocket every 1 second after ignition
System status categories:	Quantity of fuel remaining in different fuel cells during satellite launch
System change categories:	Fuel flow for production, wastage
Unit of measurement:	Litres

FORECASTING OF SMALL BUSINESS

Objective:	Forecast number of small business enterprises Australia 1997-2000
System status categories:	Numbers of small firms by location and/or year of start-up and/or type of firm
System change categories:	Startups, Failures by cause of failure
Unit of measurement:	Numbers of firms

In these environments the ability to forecast disaggregated items, such as the behaviour of fuel cells individually, could be used to ensure that the behaviour of the rocket remained within operational norms. Circumstances where actual behaviour differ substantially from forecast behaviour could indicate failures, such as fuel leaks or engine damage, and could even trigger a decision to abort if the measured data indicated too great a variance from the forecast data.

The invention may find application in many controlled environments besides the particular financial environments described.

It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.

ANNEXURE A

G/LEG97 GLOSS 17/12/96	GLOSSARY OF TERMS USED IN PATENT APPLICATION
Accounting Period	Total term of months, weeks, years for which budget, actual and forecast data are generated and controlled in the model.
Reporting Period	Individual period for which a report is required, within the overall accounting period; for example a month within a year.
Arrays	Arrangement of numbers in rows and columns, describing: (a) change or growth factors to a system, and (b) elements of the status of a system. In a financial system, for example: (a) is represented by revenue and expense accounts, summing to a profit; (b) is represented by asset and liability accounts, which with owners' equity including accumulated profits sum to zero; typically rows are used for accounts and columns are used for reporting periods. The patent application assumes all arrays contain a common unit of measurement, whether it be dollars of currency, or numbers of people, or another unit of quantity.
Budget	Estimate of data for a given reporting period, which is fixed either in absolute amount (fixed budget) or in calculation (flexible budget) for a defined accounting period. Budgets are used as an aid to controlling operations and evaluating performance. For example, a budget may be entered for sales for each month for the next year, and this is kept fixed for that year for purposes of comparing with actual sales and because many other decisions are dependent upon achievement of it - borrowing by the company for example, or recruitment of a certain level of sales and service personnel.

Forecast	Estimate of data for a given reporting period, which may be revised at any time. Forecasts are used as an aid to planning and an early warning of problem situations.
Status Category	A state or condition of a part or division of a system under study.
Change Category	A classification or division of change or growth factors applicable to a system under study.
Double-entry Accounting	Basic accounting approach, in which each transaction is entered twice (being debited to one account and credited to another account) to record the impact on the accounting equation. The accounting equation states that at any given time, the assets of a business entity equal the sum of the liabilities and the owners' equity in that business entity.

CLAIMS:

1. A forecasting control system comprising: arrays of cells for the entry and processing of data items which may represent budget, historical and forecast data for each of a number of defined reporting periods within a time period; wherein each cell in each array corresponds to a change/growth category or system status category in respect of a particular reporting period; some of the arrays are designated data entry arrays and data concerning different items of growth are entered into different data entry arrays, each cell of a summary of change factors array is arranged to automatically display data which is the sum of the data entered for the respective item of growth and for the respective reporting period on all the data entry arrays; and each cell of a closing array automatically displays data which is the sum of: the data entered for the respective category of asset and the respective reporting period on all the other arrays; plus the value of the respective cell of the closing array in the immediately preceding reporting period.

2. A system according to claim 1 wherein in each array each column represents a reporting period and each row represents a change/growth category such as revenue or expense or a system status category such as assets, liabilities or equity.

3. A system according to claim 2 wherein each column is totalled to zero in a check row to provide a control.

4. A reporting system according to claim 3 wherein a summary array is generated by summing growth items over each reporting period and includes the sum of each column in a net change row.

5. A system according to claim 4 wherein the closing array is generated by summing system status categories over each reporting period and includes the net change row from the summary array.

6. A system according to any preceding claim wherein the system is implemented in arrays, whether computerised or not.

7. A system according to claim 6 wherein the closing array shows a year to date system status and also includes a series of opening values a series of year to date values and a series of closing values.

8. A forecasting control method comprising the steps of:

displaying a plurality of data entry arrays containing cells for the entry of data representing growth and asset items for each of a number of defined reporting periods within a time period, wherein each cell in each data entry array corresponds to a particular item of growth or category of assets in respect of a particular reporting period;

entering items which may be budget, historical or forecast, concerning different growth and assets data in the cells of different data entry arrays;

displaying a summary of change factors array in which each cell automatically contains the sum of the data entered for the respective items of growth and for the respective reporting period on all the data entry arrays; and

displaying a closing array in which each cell automatically contains the sum of: the data entered for the respective category of asset and the respective reporting period on all the other sheets plus the value of the respective cell of the closing array in the immediately preceding reporting period.

9. A method according to claim 8 comprising the further step of arranging arrays so that each column represents a reporting period and each row represents a growth item such as revenue or expense or a category of assets including liabilities or equity.

10. A method according to claim 9 comprising the further step of preserving double entry bookkeeping procedures.

11. A method according to claim 10 comprising the further step of totalling each column in data input arrays to zero in a check row in order to provide a control.

12. A method according to claim 11 comprising the further step of automatically totalling the columns in the summary array in a profit row immediately proceeding the check row to provide a profit figure.

13. A method according to claim 12 comprising the further step of including the profit row in the closing array.

14. A method according to any one of claims 8 to 13 comprising the further step of before any operational data or journal entries are made filling the arrays with forecast data and deleting the forecast data and overwriting it with the actual data as they are reported.

15. A method of operating a computer spreadsheet application to provide forecasting control comprising the steps of: constructing a plurality of arrays each having the same corresponding elements in which there is identified the same item of growth or category of assets in respect of the same reporting period;

designating one of the arrays as a summary of change factors array and inserting a formula into each growth factor cell to automatically calculate the sum of the entries in the corresponding cell in each of the other arrays;

designating another array as a closing array and inserting a formula into each asset cell to automatically calculate the sum of the entries in the corresponding cell of each of the other arrays plus in the first reporting periods an opening value and in the subsequent reporting periods the value of the respective cell of the closing array in the immediately preceding reporting period.

16. A computer system including a spreadsheet application arranged to provide forecast control comprising a plurality of arrays each having the same corresponding elements in which there is identified the same item of growth or category of assets in respect of the same reporting period;

one of the arrays is a summary of change factors array in which there is a formula in each growth factor cell to automatically calculate the sum of the entries in the corresponding cell in each of the other arrays;

another array is a closing array in which there is a formula in each asset cell to automatically calculate the sum of the entries in the corresponding cell of each of the other arrays plus the value of the respective cell of the closing array in the immediately preceding reporting period.

17. Computer software to control the operation of a computer spreadsheet application to perform the method of claim 15.

18. A forecasting control system comprising arrays of cells for data items such as budget, historical and forecast data for each of a number of defined reporting periods within a time period, wherein each cell in each array corresponds to a growth or asset category in respect of a particular reporting period, the arrays comprise designated data entry arrays, a summary of change factors array and a closing array and the system is arranged for the entry and processing of the data items, and wherein data concerning different items of growth are entered into the cells of respective data entry arrays, the system is arranged to process the data items and enter in each cell of the summary of change factors array the sum of the data entered for the respective item of growth and reporting period on all the data entry arrays, and the system is further arranged to process the data items and enter in each cell of the closing array the sum of the data entered for the respective category of asset and reporting period on all the other arrays plus the value of the respective cell of the closing array in the immediately preceding reporting period.

The Patent Office

23

Application No:	GB 9626730.7	**Examiner:**	B G Western
Claims searched:	1-16, 18	**Date of search:**	13 February 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4A AUXP ; G3N NGBE1

Int Cl (Ed.6): G06F 17/60

Other: Online databases: COMPUTER, SOFTBASE, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	Dialog record 01207888 of Lotus, v3, n12, p143(19), Dec 1987, Koerner K, "Lotus-compatible software products".	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.